Gaming the FTSE 100 Index

British Accounting Review

Gaming the FTSE 100 Index

Jo Danbolt[1,*], Ian Hirst[2], and Edward Jones[3]

[1] *University of Edinburgh Business School, 29 Buccleuch Place, Edinburgh, EH8 9JS, UK, Email: Jo.Danbolt@ed.ac.uk*

[2] *School of Management and Languages (Emeritus), Heriot-Watt University, Riccarton, Edinburgh, EH14 4AS, UK, Email: I.Hirst@hw.ac.uk*

[3] *School of Management and Languages, Heriot-Watt University, Riccarton, Edinburgh, EH14 4AS, UK, Email: E.Jones@hw.ac.uk*

[*] *Corresponding author.*

Keywords:

Index Game; Index Effect; FTSE 100; Stock Market Index; Additions and Deletions

Gaming the FTSE 100 Index

Abstract

In the UK (unlike the US and many other countries), companies enter and exit the main stock market index (FTSE 100) according to a clear set of rules based on market capitalisation. This creates an opportunity to game the system to secure or retain FTSE membership by manipulating capitalisation. There is considerable evidence in extant studies that index membership is beneficial, both for shareholders and managers. Hence, companies may adopt financial strategies designed to acquire or retain membership. We investigate two types of gaming. We define strategic gaming as a situation in which companies, which may initially be a number of places away from the boundary, make abnormal share issues cumulatively over several quarters. We find strong supportive evidence for this. For tactical gaming, which would involve companies in the very closest proximity to the boundary, we do not. Our analysis shows that gaming is limited to companies outside the index trying to get in. Companies that are close to exit do not game to retain their index place. The high natural volatility of market capitalisation makes success of gaming uncertain. Our central estimate is that about 5% of entries to the index appear to be the result of gaming.

Gaming the FTSE 100 Index

1. Introduction

This paper investigates whether quoted companies in the UK manage their market capitalisations to gain entry, or avoid relegation, from the main stock market index, the FTSE 100. There is a very substantial empirical literature suggesting that membership of major stock market indices increases a company's share price and therefore lowers its cost of capital. Under these circumstances, membership becomes a valuable asset for companies. We would expect, other factors equal, that they would, where possible, actively seek to acquire this asset.

It is well established that companies manipulate their earnings and accruals (Burgstahler and Dichev, 1997), manage their own reward systems (Burns and Kedia, 2006; Heron and Lie, 2007), manage forex prices and interest rates (banks) (Gandhi et al., 2016; Ryder, 2014), and manipulate contract bids (Connor, 2011). Why should they not manage the FTSE system too? If there are specific rules which identify companies to be added and removed from the index, management can attempt to game the system by pushing their company to the front of the queue. Using data relating to the FTSE 100 index in the UK, this paper explores the evidence for such managerial index gaming. To our knowledge, this particular game has not been identified in the literature before.

The paper is structured as follows. We start by looking at the significance of indexing in current equity markets. Then we shall briefly review the arguments and evidence for downward-sloping equity demand curves. If demand is downward-sloping, the extra demand from index-tracking funds would generate higher share prices and lower costs of equity capital for FTSE 100 member companies. Under these circumstances, companies, acting in the interest of their shareholders, should be expected to actively seek membership. We shall

also review the empirical evidence for share price and other changes associated with index membership changes. We shall explain the rules governing entry and exit from the FTSE 100, noting that the rules in the UK are very different from those in the US. Our hypothesis that companies manage entry would not make sense in the US system. We then set out our hypotheses, which relate both to strategic gaming (initiated when a company may be a number of places from the margin) and tactical gaming (undertaken when the company is in very close proximity to the boundary for index inclusion). We test them using data from 2005 to 2012. Finally, we consider possible explanations for the management behaviour we uncover.

2. The significance of indices

The practical significance of indices has been greatly enhanced by academic theories. The Efficient Markets Hypothesis and Capital Asset Pricing Model have encouraged a passive style of investing based on a portfolio that includes the full set of risky assets available in the market, weighted by their market capitalisations.

The practical consequence of these developments has been that index-tracking funds now hold a significant portion of the global equity pool. In the US, the percentage rose from 11.4% in 2003 to about 18.4% in 2013 (Doshi et al., 2015), while in the UK, 20% of the market was in fully passive strategies in 2014 (Investment Association Asset Management Survey, 2015). Passive funds now account for about 20% of global fund management assets, and while assets under management in active funds grew by 54% to $24trn between 2007 and 2016, funds in passive mutual funds grew by 230% to $6trn over the same period, amid concerns about bad performance and high fees of active funds (Mooney, 2016).

These numbers, however, understate the significance of index membership for investment decisions. There is evidence of substantial 'closet indexing' (Authers, 2014; Duncan, 2015). Petajisto (2013) reports that it has been increasing in popularity and now accounts for about one third of all mutual fund assets in the US. Using information from several sources, Marriage (2016) estimates that a third of UK funds and 55% of Swedish funds are potential closet trackers. Basak and Pavlova (2013) show that even benchmarking against an index, a very widespread practice, can be expected to tilt a portfolio in the direction of shares included in that index. These facts show that entry to the main index used for index-tracking will generate substantial new demand for the shares affected (and exit will cause a substantial source of demand to disappear). How will this affect the share price and the incentive for companies to be included in the index?

3. Demand curves for equities

In a market with perfect symmetrical information, we would expect highly elastic, nearly flat, demand curves for individual shares. Investors could find close substitutes for shares removed from the open market by index trackers. However, the diversity of investor portfolios and the volume of investor trading suggest a very different market environment. Scholes (1972), Miller (1977) and Levin and Wright (2006) all make the argument for downward-sloping demand curves in the context of heterogeneous beliefs. Merton (1987) offers a detailed theoretical analysis of how incomplete information can be expected to produce a market in which the prices (and returns) on individual shares will vary with the number of investors interested in purchasing them. Several authors have estimated demand elasticities (see e.g., Shleifer, 1986; Ahern, 2014). Petajisto (2009, p. 1015) concludes that "(index and) non-index evidence points in the same direction: demand curves for individual

stocks are steep *in general*". Petajisto (2011) finds that elasticity increases with firm size and decreases with idiosyncratic risk. With downward-sloping demand, it can be expected that index entry, by reducing the quantity available in the open market, will raise share prices and index exit will lower them. The downward-sloping demand argument is often referred to in the literature as the imperfect substitutes hypothesis. It is central to our argument, but it is only one of several models of index entry and exit, which we review next. A number of them could be used to motivate our hypotheses.

4. Index Effects and Motives for Firms Seeking Index Membership

Prior literature examines the impact of index entry and exit on company share prices, and various theories have been put forward to explain the stock market reaction to companies gaining or losing membership of main stock market indices. Below we review some of the main theories and evidence on index effects, which may motivate a desire for companies to gain index membership.

4.1 Imperfect Substitution

One of the most widely cited early studies of the price reaction when a stock joins the S&P 500 is by Shleifer (1986). Along with many S&P studies, he only looks at additions; the effects of removal cannot generally be studied because the companies disappear. Shleifer finds a first day 'pop' of 2.79% when companies joined the index, and his results suggest that the price rise is permanent. In the absence of homogeneous information, stocks may face a downward-sloping demand curve from non-tracking investors. When the company joins the index, tracking funds remove a slice of the issued stock from the market, shifting the supply

curve for non-tracking investors to the left. The remaining equity finds its equilibrium price higher up the demand curve. If shares outside the index are seen as imperfect substitutes for those inside, there exists a clear motivation for companies to actively seek index membership. A more recent study in this vein is Chang and Hong (2015) who find a price movement of about 5% when stocks gain demand by moving into a new index. There is additional evidence for downward-sloping demand from index changes whose effect is not contaminated by possible information changes. Petajisto (2009) refers to the removal of foreign companies from the S&P 500 in 2002, and Kaul et al. (2000) look at the re-weighting of the Toronto TSE 300 in 1996. In both cases it is difficult to interpret the significant price changes as being other than demand related. If index membership leads to permanently higher demand for a company's shares, and thereby higher share prices and lower cost of equity capital, index membership will be desirable.

4.2 Price Pressure

Harris and Gurel (1986) find an immediate gain from S&P membership of 3.13%, while Mase (2007) finds abnormal returns of approximately 4% when firms are added to the FTSE 100 index. However, in both studies the price rise is found to be temporary. Harris and Gurel (1986) argue that the sudden extra demand generated by tracking funds is satisfied by high cost suppliers of extra liquidity. These liquidity suppliers sell on the effective date and restore their own investment positions by buying as the price comes back to its equilibrium level. The findings of Harris and Gurel (1986) and Mase (2007) of only a short-term price pressure effect from index inclusion suggest that companies should take a neutral view of entry or exit from an index.

4.3 Information and Liquidity Effects

Despite the assertions of S&P, there may be information content in the announcement that a specific share is to join the index. Dhillon and Johnson (1991) find that trading volume increases after entry is announced, and that the effect is still evident one year later. They argue that, once within the index, a company may be subject to closer scrutiny and agency costs may fall. If trading volume (and liquidity) rises, spreads may fall and this, logically, will increase the current value of the share. Members of the index would see a permanent increase in value.

For the FTSE 100 it is practical to look at both additions and deletions, and it is appropriate to look at movements before the announcement date because both entry and exit can be foreseen. Gregoriou and Ioannidis (2006) find excess returns of 11% over the 5 day period centred on the announcement day, but these are partly reversed over the following months. For deletions, the 5-day excess returns are -7.4%, with share prices continuing to fall. Gregoriou and Ioannidis (2006) argue that the permanent change in prices is associated with changes in information costs and liquidity. Mazouz et al. (2014), using FTSE 100 data, also show that index entry enhances all aspects of liquidity and that liquidity is priced. The resulting price rise is permanent. However, being relegated from the index does not result in a reversal of the liquidity or price changes. The increase in liquidity and associated increase in share prices from index membership provides another motive for companies seeking to get into the FTSE 100 index. There is, however, mixed evidence as to whether or not being relegated from the index has a permanent negative impact on liquidity and share prices.

4.4 Price Volatility

Dunn et al. (2008) find that, although additions to the FTSE 100 index exhibit positive cumulative abnormal returns (about 3%) prior to the effective date, this is followed by a long period of negative abnormal returns. Deletions show a mirror image of this effect, although the movement before day 0 is stronger (-5%) and the subsequent recovery weaker. Stocks in a widely tracked index have a significant proportion of their market capitalisation locked away, and the traded capitalisation is smaller. Contrary to other studies finding index inclusion to have a positive impact on liquidity, Dunn et al. (2008) find that for additions, the shares become more volatile and less liquid, and the long-term effect on prices to be negative. Cooper and Woglom (2003) confirm that volatility increases when a share is added to the S&P 500 index. The authors suggest that the increased volatility is responsible for a price decline after the initial announcement increase. If index membership leads to higher price volatility and lower share prices, index membership would arguably be best avoided.

4.5 Awareness and Coverage

Mase (2007) finds that, around the time of a firm being added to the FTSE 100 index, the average number of analysts rises from 5.92 to 7.24, and for deletions, coverage falls from 5.92 to 3.26. Analysts do not initiate or terminate coverage on a short-term basis. They obviously expect index membership to have a long-term impact. Several authors report effects from joining the S&P. Chen et al. (2004) find that the total number of shareholders rises substantially (and the number of institutional owners rises too) when a company is added, but does not fall so significantly when it leaves. They argue that investors become aware of a company when it joins the index; they do not become unaware when it leaves. Denis et al. (2003) suggest that S&P additions enjoy significant improvements in the

accuracy of earnings per share (EPS) forecasts. They suggest that closely monitored index members may have better and cheaper access to the capital markets. Elliott et al. (2006) also conclude that substantial price changes associated with index entry are permanent and primarily associated with increased investor awareness. Chan et al. (2013) confirm that there are long-term effects from index membership, and also attribute them mainly to improved liquidity associated with greater analyst coverage. Awareness and liquidity are closely related in the literature. This evidence suggests that companies obtain benefits from index membership.

4.6 Earnings Quality

Platikanova (2008) looks at earnings quality for companies that join the S&P Index. Focusing on accruals, she shows that when companies join the index, discretionary accruals fall (i.e., there is a more conservative accounting policy), earnings become higher quality, and this reduces information risk and increases the share price. Platikanova (2008) argues that this is a permanent effect and that shares added to the index outperform for at least three years after the event. Again, this evidence suggests that index membership is beneficial to shareholders.

4.7 Managerial Issues

It is also possible that executives and directors might have personal reasons for seeking entry. There is considerable status associated with senior positions in FTSE 100 companies. The benefits may, however, go beyond mere status. Studying compensation data for UK CEOs and executive directors, Geiler and Renneboog (2015, p. 351) find "…strong positive

relation between firm size and remuneration: executive directors in the FTSE100 firms earn almost the double than FTSE250 executives, three times as much as executives of FTSE Smallcaps, and about five times as much as the executives of FTSE Fledglings". Main and Hine (2012) also study the determinants of executive pay in the UK and find index inclusion to have a significant impact on executive pay, even when controlling for firm size, share performance and director characteristics, using firm fixed effects and year dummies. Main and Hine (2012, p. 9) find that "Current membership of one of the FTSE indices is, of itself, a powerful positive influence on earnings". The coefficient on FTSE100 is significantly larger than that for FTSE250, suggesting that executive pay, after controlling for other variables, is significantly higher when firms are in the FTSE 100 than when they are not. This suggests managers would have personal incentives to ensure their firm gains or maintains membership of the FTSE 100 index, irrespective of whether index membership is beneficial to shareholders or not.

4.8 Press Comment

In 2011 and 2012 there was concern in the UK about foreign companies (mainly from the former Soviet Union) which had obtained entry to the FTSE 100 despite a low free float and corporate governance structures which were not subject to UK control. The FTSE organisation proposed to change the rules to exclude them. The reaction from the businesses affected was swift and hostile. The Financial Times carried articles such as "(Polymetal's) founder talks about why he has set his sights on the FTSE 100" (Kavanagh, 2011) and "Resolution has hit out at a planned clampdown on unconventional corporate structures which threatens the life assurance group's position in the FTSE 100 index" (Gray, 2012, p.

23). It is clear from articles such as these that managers often have a strong desire for their firm to be included in the FTSE 100 index.

4.9 Literature Conclusion

As is so often the case, this substantial body of literature contains varied and sometimes contradictory arguments and findings as to whether companies benefit from being a constituent firm in a major stock market index such as the FTSE 100. Overall, however, we would endorse the view of Chan et al. (2013, p. 4921), who conclude their review of current literature with the statement that "Clearly there are several fundamental reasons to expect a permanent, long-term price effect from the addition of a stock to the index. …the driving factors for added stocks should work in the opposite direction for deleted stocks". This would suggest that companies, maybe particularly those around the boundary for index inclusion, would have incentives to try to manage their market capitalisation so as to gain or maintain index membership, or to avoid being dropped from the index. This motivates our hypothesis.

5. FTSE Index Entry and Exit

For the FTSE 100, the selection process is objective. All 90 largest eligible firms by market capitalisation are automatically included. If any index stock moves below the 110th position, it is automatically excluded at the next review and the largest non-index stock takes its place. At any point in time, therefore, the index will consist of the top 90 shares by market capitalisation at the beginning of the quarter plus 10 further shares drawn from those that were ranked, at the beginning the quarter, between 91 and 110. The system leads, on average, to 2 or 3 changes at each quarterly review.

Because additions and deletions in the UK follow an automatic rule, investors can make very good guesses about constituent changes in advance of the formal announcement. The automatic rule used in the UK raises the possibility that company management might game the system by making positive abnormal capitalisation changes when they are at risk of being ejected from the index, or when they are close to being admitted. We shall test whether this is in fact the case.

It is worth noting that the situation in the US is quite different. The main index used for tracking and benchmarking there is the S&P 500. There are no regular reviews of membership. Firms leave the index when they are acquired, go bankrupt, or, rarely, undergo some restructuring that makes them unsuitable to continue in the index. The S&P index committee holds a secret list of approved firms and, when one firm leaves, a successor is announced to take its place. Although the S&P committee is clear that the firms on the reserve list have not been selected for their potential investment returns (S&P, 2015), it is sometimes argued that the selection criteria (which include financial viability) may in fact convey information about investment quality. Some of the American literature, not discussed above, suggests that this implicit information may be a driver of the index effect in the US. There is no subjective selection, and no possible information effect, in the UK. The hypothesis of this paper – that firms might manage their entry to the index – would make no sense in a US context.

6. The Index Game

In this paper we test the hypothesis that companies game the FTSE system by abnormally increasing their number of issued shares, and hence their market capitalisations, when they are close to entry or exit from the FTSE 100 index. Share issuance is, of course,

not the only way in which companies can change their capitalisations. They might fail to make buy-backs that they would otherwise have made, or reduce their dividend payments. Regular dividends are traditionally stable from year to year and unsuitable for index manipulation. Special dividends are rare and have the effect of reducing capitalisation. If companies are going to artificially increase their market capitalisations to trigger FTSE entrance (or avoid exit), evidence for this should show up in the pattern of share issuance and redemption.

In proposing this hypothesis, we are assuming that issuing new shares will, in fact, increase the firm's market capitalisation. It is possible that the share price might react so negatively to the announcement of the new issue that the expected increase in capitalisation is not actually achieved. Bali et al. (2013) find a positive relationship between issuance and returns for most of the countries in their sample, but with a notable exception for larger capitalisation UK stocks. This result might be related to information flow implications of the issues. An issue made with the intention of entering the FTSE index, if this intention was identified by investors, would presumably not carry significant information implications. Armitage (2012) finds discount-adjusted returns for UK firms are insignificantly negative for rights issues and significantly positive for the more numerous open offers and placings. Transactions costs might also influence the desirability of issues and redemptions. It should be noted that firms can increase their number of shares without making any sort of formal issue, by using shares as consideration for minor acquisitions or creating new shares to redeem executive share options.

Our basic hypothesis can be derived from several possible motivating factors. If management believes in either the imperfect substitution, or the information and liquidity arguments, or if they are persuaded by the evidence relating to awareness and coverage, they can be expected to actively seek to be included in the Index if their company's market

capitalisation is in the vicinity of the boundary for being included in the Index, as being included in the Index will enhance the wealth of their shareholders and reduce their cost of equity capital. A company's CEO and senior managers might also seek membership because it will increase their personal compensation. If, on the other hand, they believe in the price volatility argument, they would be expected actively to avoid membership. Systematic avoidance behaviour would also show up in our tests. Although, as so often, the empirical evidence is not unanimous, our hypothesis that firms close to the boundary may try to game the system so as to gain entry or avoid exit from the FTSE 100 is well grounded in both theoretical and empirical literature.

We shall test whether companies in the vicinity of the FTSE 100 boundary show an unusual propensity to make large share issuances. Given the transparent rules for index membership, allowing for potential gaming, we hypothesise that companies close to the boundary for inclusion or in danger of dropping out of the index are more likely to undertake large share issues than firms either safely within the index, or so far below the boundary that membership of the index is unlikely. We note that the FTSE rules mean that a company which just succeeds in gaining FTSE membership has a more secure asset than one that just evades exit. Also, the awareness argument suggests that the gains associated with entry may not be lost on exit. Based on these two arguments, we test both to see whether companies are active in seeking to acquire membership and also whether they manage their capitalisation to stay in the index when they are close to exit.

Gaming can arguably take place in different ways, and we test two distinct variants. One is strategic gaming, where a company whose market capitalisation may initially be some distance away from the boundary for FTSE100 index membership, pursues its objective through large scale issuance over a number of quarters. The other is tactical or opportunistic gaming, where a company finding itself in very close proximity to the boundary boosts its

capitalisation to grasp entry (or avoid exit).These two variants of the game are not alternatives. We may find evidence of both, or neither, and we test them separately.

Tests for strategic gaming use a data-set of the 200 largest FTSE-eligible companies listed on the London Stock Exchange. Tests for tactical gaming use a data set of near-boundary companies. Our tests are based on the ten smallest companies in the index (proxins) and the ten largest companies outside it (proxouts). As a by-product of these tests, we expect to estimate the number of companies that, over the eight years of our data, have achieved or retained FTSE membership by gaming.

7. Data and Methods

We examine the propensity of management to use capitalisation changes to gain entry to the FTSE 100 index. We collect quarterly market value, number of shares in issue, and share price data for companies from Datastream. Data was collected from March 2005 to December 2012, giving a total of 32 quarters. Datastream does not directly indicate membership of FTSE indices or the ranking of companies within the index. The most convenient source for data giving both market capitalisation and FTSE membership information is the Stockchallenge (SC) website, which was created to facilitate a 'play the stock market' game. We have confirmed the SC data by checking market capitalisation data against Datastream and entries and exits to the Index against the London Stock Exchange quarterly review of index constituents (FTSE 2005 – 2012). The SC website ranks companies by market capitalisation and indicates membership of the FTSE 100 or the FTSE 250.

We examine whether companies have an increased propensity to issue stock when in proximity to the index boundary, i.e., as the company approaches entry to or exit from the

FTSE 100 index. The proximity to the index boundary is determined separately for companies inside and outside the index. For companies inside the index, but proximate to exit (proxins), we begin by sorting index constituents in a particular quarter in terms of their market capitalisation. We exclude companies which have been identified by SC as automatic exits at the next review of the list of index constituents. We then rank companies from -1 to -10, with -1 as the nearest (non-automatic) FTSE 100 listed company to exit from the index. We then repeat this process to identify the nearest companies outside of the index (proxouts). We rank companies outside the index by market capitalisation and then, excluding automatic entries, code the nearest company to being in the index as 1 and the tenth nearest as 10.[1] The actual company in any given position will be different for each quarterly set of data. Companies are very unlikely to find themselves in the same rank positions in consecutive quarters. To assess the change in index position over time, we examine the six quarters after each ranking quarter (Quarter 0).

Our hypothesis is that companies close to the margin for FTSE100 entry or exit will increase their market capitalisations to increase their chances of getting or staying in. To test this, we have calculated the Share Inflation Factor (SIF) for the companies in our database. The SIF for quarter Q is defined as

$$\mathrm{SIF(Q)} = \frac{\mathrm{NOSI(Q)} - \mathrm{NOSI(0)}}{\mathrm{NOSI(0)}}$$

where NOSI(0) and NOSI(Q) refers to the number of shares in issue at quarter Q and quarter 0, respectively, with appropriate adjustments being made for stock splits. SIF therefore measures decisions by companies to change their market capitalisations by issuing or repurchasing shares.

[1] Note that for each automatic exit there will be a corresponding automatic entry to maintain the number of companies in the index.

In our data-set, Q takes on the values +1 to +6. We look at adjustments to the share count up to six quarters after a company has occupied a particular position in the size rankings. A positive SIF means that the number of shares is rising.

8. Characteristics of the Data Set

In Table 1 we present descriptive statistics for market capitalisations and SIFs of index boundary companies (ranked 91 to 110 inclusive) and market capitalisations at ranks 90 and 111. Notice that the mean market capitalisation at rank 90 is 32.3% higher than at rank 111. In very broad terms, market capitalisation tends to rise by about 1.4% for every step up the size-ranking list. A company that automatically enters the FTSE 100 index at rank 90 therefore has a substantial capitalisation cushion before it would automatically exit at rank 111. One implication of this is that the incentive for companies nearing the boundary for entry to gain entry is stronger than the incentive for firms close to exit to fight to stay in (where the company is likely to stay in peril even if it temporarily avoids the drop).

Table 1 about here

SIF statistics are shown for one, two, four and six quarters. On average, they are slightly positive. Note the substantial SIF standard deviations. The mean one quarter SIF is less than 0.1%, but the standard deviation is almost 5%. Note that the maximum Q+1 SIF is 9.6 standard deviations from the mean, and the minimum is 6.5 standard deviations away. Many companies have zero SIFs. The distribution is clearly leptokurtic. For this reason, non-parametric Chi-squared tests are used, where appropriate. As one would expect, SIFs tend to be larger, and to have a larger standard deviation, over longer time periods. We look at SIFs over a range of time periods because managed share issuance takes some time to arrange. Some issuance (e.g., the exercise of management options) will not be under short run company control. Other issuance (such as share issuance to fund a take-over) may well take

longer than one quarter to carry out. Gaming the system through a sequence of share increasing moves would take longer again. We shall look as far as six quarters into the future, which is a generous allowance for the implementation of a share issuance policy.

Table 2 about here

Table 2 shows the pattern of movement to and from the Index. As Table 1 has shown, SIFs that will move a company ten or more places up the capitalisation rankings are rare. However, natural share price movements on this scale are less rare, and Table 2 shows a pattern of very substantial ranking changes. 73% of companies that enter the Index were within ten places of entry the previous quarter, but only 13% of them were in such a 'proxout' position six quarters earlier. In our data set, two companies enter the Index which had been ranked below 200 six quarters previously. As Table 2 shows, some entries are in fact re-entries. A quarter of all the companies that enter the Index were within it six quarters before, but have dropped out and are now returning. Some Index entrants and exits have moved a very long way up or down the rankings in the preceding quarters. An index game would have to be played against a turbulent background.

Table 3 looks at what SIF would be required to secure FTSE entry by moving to rank 90 if companies could theoretically change their size instantaneously. For companies in position +1, a modest positive SIF can sometimes do the job. A 1% SIF will move a company in almost 10% of the time; 5% will do it 29% of the time; and 20% would be successful for every case in our data set. Note that the company in position +1 is not necessarily at rank 91. It may be necessary to leapfrog several companies to gain immediate entry.

Table 3 about here

For companies further away from entry, larger SIFs would be needed. A 2.5% SIF does not push any company ranked +2 or above into the index. 5% only helps companies ranked +1 or +2. Table 3 shows that even 20% SIFs do not move companies at the bottom of the

proxout list into the Index. This motivates our decision to focus on companies within 10 places of entry/exit as being the most likely to exhibit index gaming behaviour. We shall then go further and look at patterns of share issuance by companies within these two proximity groups.

While the analysis in Table 3 has been undertaken looking at different levels of SIF, we shall concentrate on SIFs of 10% or more. These are large enough, as Table 3 shows, to have a significant effect on a company's capitalisation ranking. They are also common enough, as Table 1 has shown, to give an adequate dataset.

9. Results

9.1 Testing for Strategic Gaming

We consider the possibility that the sets of companies within 10 places of exit or entry to the FTSE are actively enhancing or protecting their positions. Table 4 includes all the eligible companies on the London Stock Exchange ranked from 1 to 200 by market capitalisation. The top hundred and the next hundred are divided into size deciles, except for the companies ranked 91-110, which are divided into 10 'proxins' (the smallest firms in the index) and 10 'proxouts' (the largest firms outside the index). We are concerned to see whether the share issuance behaviour of these two groups of companies is different from that of firms in the other 180 positions.

Table 4 about here

Table 4 looks at all positive SIFs exceeding 10%. The evidence that proxin companies, when compared to other companies in the index, have an abnormal propensity to make these large SIFs is very slight. Over 6 quarters, they are less likely to do so than the average company in the range 1-90. Over 1, 2 and 4 quarters, the propensities are modestly

above average, but the proxins are not the highest issuing group over any time period. There is no substantial evidence here of gaming.

The evidence in Table 4 is different for the proxouts. Over 2, 4 and 6 quarters, the proxouts have a higher proportion of large SIFs than any other group in the 111-200 capitalisation range. Indeed, over Q4 and Q6, the proxouts are bigger issuers than any of the other nineteen groups. This offers initial support for gaming by proxouts even though there is no such evidence for proxins.

Share issuance is, of course, likely to be influenced by factors other than FTSE ranking position and whether or not the firm is close to the index boundary. We therefore add to the analysis as control variables three financial variables expected to influence firms' share issuance behaviour. The variables, commonly used in the capital structure literature (see, for example Harris and Raviv, 1991) are the Debt/Total Asset ratio (DTA), the Dividend Yield (DY), and the Market-to-Book ratio (MBR). We also control for size using the natural log of market value (LnMV). The basic characteristics of these variables in our data set are given in Table 5. This shows that proxins have a significantly higher MBR ratio, and proxouts a lower one, compared to the rest of the top 200 companies. The differences in the other ratios are not so marked.

Table 5 about here

We investigate in Table 6 whether these firm characteristics can account for the high share issuance by proxout companies, or whether the index boundary position of a firm still affects SIF behaviour, which would be suggestive of gaming. In Panel A of Table 6 we report results of a probit analysis which seeks to explain SIF behaviour using these financial variables, as well as proximity to FTSE entry or exit.[2] Four different time periods (Q1, Q2,

[2] With respect to endogeneity, we do not suspect either an unobserved confounder which affects proxout/proxin and SIF10Q4 or a loop of causality in our framework. Only effects on the explanatory variables (proxout/proxin) are a concern in models in Table 6. We are not aware of any endogenous effects regarding the

Q4, and Q6) are analysed. The dependent variable is a dummy recording whether a SIF of the given size has taken place in the given period. Our main variables of interest are proxin and proxout, while DTA, DY, MBR and LnMV control for other factors likely to influence the share issuing behaviour of firms. For SIFs above 10%, the proxouts are significant at the 5% level over four quarters which is strong evidence of strategic gaming activity. There is significance at 10% over six quarters. There is no similar evidence for proxins and nothing in the Table supports the gaming hypothesis in their case. With regard to the control variables, the analysis shows that the debt ratio (DTA) has a significantly positive relationship with issuance (consistent with most leverage models) and MBR has a significantly negative relationship (consistent with the pecking order hypothesis). Dividend yields are not significant. However, strong evidence of gaming remains present even when these other variables are controlled for in the analysis.

Table 6 about here

Panel B of Table 6 uses the same probit approach looking specifically at Q4 data. Analysis of the Q6 data gives similar results but with a smaller sample size and is not reported here. The same regression is conducted for a number of subsets of the data. The regression coefficients relating to debt are noteworthy. It might be argued that proxouts would have a particular propensity to play the game when their debt levels were high and they could conveniently gain capitalisation by exchanging debt for equity. Panel B does not support this relationship. The link between debt and large SIFs, although consistently positive, is weaker for proxouts than any other subset. We extended the analysis to include interactive terms, but we found them to be uninformative. Overall, our results, as presented in Table 6 suggests the high frequency of large share issues by companies ranked just outside

proxout/proxin variables either through the literature or by observation which would cause both our explanatory variables (proxout/proxin) and SIF10Q4. There is also no reason to suspect a feedback loop between SIF10Q4 and proxout/proxin.

the boundary for index membership (proxouts) cannot be fully accounted for by firm characteristics other than their ranking position. Our evidence is consistent with index gaming.

Evidence of gaming is pursued further in Table 7. Again, it looks specifically at Q4 SIFs above 10%. For each company the probability of generating such a SIF has been calculated using the probit regression in Table 6 Panel B, Model (iv). The probabilities are then averaged for each group of ten, with, again, companies closest to the boundary being divided into proxins and proxouts and all others being simply ranked by capitalisation. For each group of 10 the expected number of large SIFs is calculated and compared with the actual number observed.

Table 7 about here

Although the statistical significance of anomalous proxout behaviour has already been demonstrated in Table 6, the effect of presenting the data in this way is striking. There is no excess of SIFs for proxins, but for proxouts there are more than 15 excess SIFs – nearly twice the expected number (31 compared with an expectation of 15.92). This is the largest number of excess SIFs for any of the 20 groups. It is significant at the 1% level using a Chi-square test. It is, again, clear evidence of gaming, with companies just outside the index boundary having many more large share issues than would be expected by firm characteristics or chance. We also note that the abnormal SIF is also marginally significant for the firms ranked 111-120, possibly suggesting that some of the firms in these positions may also have engaged in unusual SIF activity. Further analysis shows that the average size of the Q4 proxout SIFs is 30.3%. However, these proxout companies can be as many as ten places away from entry, so even these very large SIFs may not be sufficient to gain entry.

The fact that the gaming evidence can be found in patterns of issuance over four quarters (and not over one or two quarters), and by companies up to ten places from the

boundary is evidence of strategic gaming behaviour. Some companies are making active bids for FTSE membership, starting a significant distance from the boundary and continuing over a period of four quarters.

The pattern may go on beyond four quarters. The 31 cases of large proxout issuance over four quarter periods actually relate to only 19 different companies. Only 9 out of the 19 actually get in during the period of our study. Others, of course, may still be trying when our data set ends and may eventually succeed. Since slightly less than half of the 31 issuances have been identified as abnormal, this would suggest that, over the 8 year period of our data set, only about four of the 76 entries to the FTSE index have been the result of firms gaming the system. This number is based only on the 10 proxout companies, over four quarters, making SIFs above 10%. We have found that these specific parameters, among those we have explored, give the strongest evidence of gaming, but other model specifications might possibly have captured additional gaming behaviour.

9.2 Testing for tactical gaming

We now look more closely at companies within the proxin and proxout categories. We test to see whether the propensity to make large SIFs is highest for companies in the very closest proximity to entry or exit.

Table 8 about here

Table 8 Panel A shows the proportion of SIFs above 10% by ranking position. The company ranked -1 is in the index but closest to exit. Rank -10 is ten places from exit. The companies outside the index are similarly ranked +1 to +10. The table covers 1, 2, 4 and 6 quarters.

We have already shown that the proxouts, as a group, have an unusually high propensity to make large SIFs. But Table 8 shows that this propensity is not concentrated in

companies at the most marginal positions. Proxout companies at ranks 1, 2 and 3 are less likely, and, in some cases, significantly less likely, to issue shares than those further away from the boundary. The highest proportion of large share issuances happens to be associated with position +4, and there is no overall tendency for SIFs to increase as companies move closer to the border.

For proxins the picture is different. There are no large SIFs at all in our dataset for the very closest companies to exit. However, there is higher issuance by the five companies closest to exit compared to the remaining five.

This is investigated further in Table 8 Panel B, which shows correlations between index positions and SIF probabilities. Only one correlation is significant, that relating to proxouts over six quarters. However, it has the wrong sign for our hypothesis; large SIFs are more likely for companies further away from the boundary.

The evidence, therefore, does not support tactical or opportunistic gaming by companies on the very margin of entry or exit. It does support strategic gaming, by companies outside the index, carried out over a number of quarters, by companies which may initially be a single-digit number of places away from the boundary.

9.3 Limitations of gaming

It is interesting to consider why more companies don't play the game. Perhaps the probability of winning is too low to attract many players. Table 9 shows the risks that FTSE gamers would face. Over a single quarter, companies typically move a little more than 7 places in the ranking table. Where capitalisation changes are proportional to general market movements, company rankings and therefore FTSE status will not be affected. However, after removing this element, and looking only at the firm-specific capitalisation changes, we find quarterly absolute changes of 12.5% for proxouts and 13.4% for proxins. These numbers

are larger than the 10% that we have defined as large SIFs. Such SIFs are relatively rare in the data set. The average quarterly SIF in Table 9 is less than 1%, which is far smaller than the average quarterly change in capitalisation caused by firm specific risk. Even a large positive SIF, therefore, might very well be counteracted by a negative change in the share price – or rendered unnecessary by a natural positive change in the share price.

Table 9 about here

This degree of natural volatility illustrates the risk of losing for any company tempted to play the FTSE game. Also, manipulation of market capitalisation would come at a price. Issuing additional equity may involve significant transaction costs. It may also result in a tax-inefficient low debt-equity ratio, or the acceptance of unattractive investment opportunities, or both. These costs are hard to quantify, but are likely to be significant when balanced against the highly uncertain benefits of trying to game the FTSE system. Our evidence suggests that some companies do find the game worthwhile, but a substantial majority do not.

10. Conclusion

Although there is a large literature relating to the effects of index membership changes, we believe we are the first to pose the question of whether companies manipulate their market capitalisations to secure or maintain membership. Based on an analysis of the FTSE 100 index, we find evidence that they do.

We find that some companies game to secure entry to the FTSE, but find no evidence of gaming to try and avoid exit. This finding is consistent with the strand in the literature which argues that companies benefit from a higher profile and greater awareness when they join the index, but do not lose this benefit when they exit. It might also be explained by the FTSE rules. Gaining entry offers membership with a substantial buffer against exit. A capitalisation increase by a company near exit offers no similar incentive.

Our investigation identifies two different ways of playing the game. It could be played tactically, with a company very close to the boundary for index inclusion grasping a fleeting opportunity. Or it could be played strategically, where a company which may initially be some distance from the boundary, makes capitalisation changes over a longer time period with the aim of getting into the FTSE100 index. The evidence on this point is clear. It does not support the tactical gaming hypothesis. Gaming is pursued strategically. Some companies, which may initially be up to ten places from the boundary, appear to have adopted an objective of building a FTSE company, and have pursued this objective systematically over multiple quarters.

The game is risky. Even when played strategically, our evidence shows that only slightly less than half of companies in our data set which make large Q4 share issuances from positions just outside the index (proxout) actually gain entry. The natural volatility of market capitalisation can readily frustrate gaming companies.

Although we have found clear evidence of gaming, we have also found that the amount of gaming is relatively modest. Within our data set, roughly 5% of companies gaining entry to the FTSE index appear to have used gaming.

Acknowledgements

We are grateful to Nathan L. Joseph (Joint-Editor), an anonymous reviewer, Alan Goodacre, David-Jan Jansen, Stergios Leventis, Bill Rees, participants at the Scottish BAFA (St Andrews) 2014, the World Finance Conference (New York) 2016, and seminar participants at the International Hellenic University and Heriot-Watt University for helpful comments on previous versions of this paper. Jo Danbolt holds the Baillie Gifford Chair in Financial Markets, and his research is partially funded by a Baillie Gifford endowment held by the

University of Edinburgh Business School. Baillie Gifford has no role in or influence over the research conducted.

Appendix: FTSE Ground Rules

The index was originally started by choosing the 100 largest companies on the London Stock Exchange based on the market capitalisation of equity. Thereafter, the list of constituents is reviewed every quarter. The FTSE (2012) Ground Rules Section 5 provides detailed information on index qualification criteria and Section 6 information on the periodic review of constituent companies. All 90 largest eligible firms by market capitalisation are automatically included. If a new company enters the top 90, it pushes out the smallest company currently in the index. Similarly, if any index stock moves below the 110th position, it is automatically excluded at the next review and the largest non-index stock takes its place. At any point in time, therefore, the index will consist of the top 90 shares by market capitalisation at the beginning of the quarter plus 10 further shares drawn from those that were ranked, at the beginning the quarter, between 91 and 110.

The Ground Rules outline a number of key aspects of the constitution of the FTSE 100 index. Section 7.1.2 of the FTSE (2012) Ground Rules notes that: "Where the company to be removed is a constituent of the FTSE 100, the replacement company will be taken from the highest ranking company on the FTSE 100 Reserve List and a constituent removed from the FTSE 250 will be replaced by the highest ranking company on the FTSE 250 Reserve List."[3] Reviews take place on the Wednesday after the first Friday of March, June, September and December.[4] Changes agreed by the review are implemented after the expiration of index futures and options which is the third Friday of the same month.

[3] With respect to M&A, Section 7.2.1. explains that "If the effect of a merger or takeover is that one constituent in the FTSE 100 or FTSE 250 is absorbed by another constituent, the resulting company will remain a constituent of the appropriate index, and a vacancy will be created. This vacancy will be filled by selecting the highest ranking security...".

[4] Our data on market values and share prices is collect for the date on which the periodic review is released.

References

Ahern, K.R. (2014). Do Common Stocks have Perfect Substitutes? Product Market Competition and the Elasticity of Demand for Stocks, The Review of Economics and Statistics, 96(4), 756–766.

Armitage, S. (2012). The Calculation of Returns During Seasoned Equity Offers, The European Journal of Finance, 18(5), 393-417

Authers, J. (2014). Active Fund Managers are Closet Index Huggers, Financial Times, 13 March, 30.

Bali T.G.,and Murray S. (2013). Does Risk-Neutral Skewness Predict the Cross-Section of Equity Option Portfolio Returns? Journal of Financial and Quantitative Analysis, 48, 1145-1171.

Basak, S. and Pavlova, A. (2013). Asset Prices and Institutional Investors, American Economic Review, 103(5), 1728–1758.

Burgstahler, D. and Dichev, I. (1997). Earnings Management to Avoid Earnings Decreases and Losses, Journal of Accounting and Economics, 24, 99-126.

Burns, N. and Kedia, S. (2006). The Impact of Performance-Based Compensation on Misreporting, Journal of Financial Economics, 79, 35-67.

Chan, K., Kot, H.W. and Tang, G.Y.N. (2013). A Comprehensive Long-Term Analysis of S&P 500 Index Additions and Deletions, Journal of Banking & Finance, 37, 4920–4930.

Chang, Y-C., Hong, H. and Liskovich, L. (2015). Regression Discontinuity and the Price Effects of Stock Market Indexing, The Review of Financial Studies, 28(1), 212-246.

Chen, H., Noronha, G. and Singal, V. (2004). The Price Response to S&P 500 Index Additions and Deletions: Evidence of Asymmetry and a New Explanation, The Journal of Finance, 59(4), 1901-1929.

Connor, J.M. (2011). Has the European Commission Become More Severe in Punishing Cartels? Effects of the 2006 Guidelines, European Competition Law Review, 1/2011, 27-36.

Cooper, D. and Woglom, G. (2003). The S&P 500 Effect: Not So Good in the Long Run, Journal of Investing, Winter, 62-73.

Denis, D.K., McConnell, J.J. Ovtchinnikov, A.V. and Yu, Y. (2003). S&P 500 Index Additions and Earnings Expectations, The Journal of Finance, 58(5), 1821-1840.

Doshi, H., Elkamhi, R. and Simutin M. (2015). Managerial Activeness and Mutual Fund Performance, The Review of Asset Pricing Studies, 5(2), 156-184.

Duncan, E. (2015). 'Closet Tracker' Funds More Than Double in the UK, Financial Times, 15 June, FTfm 9.

Dunn, P., Hamill, P. and Opong, K.K. (2008). Spot Market Effects Surrounding Compositional Changes to the FTSE 100: Transitory or Permanent? Working Paper, University of Glasgow.

Dhillon, U. and Johnson, H. (1991). Changes in the Standard and Poor's 500 List, Journal of Business, 64(1), 75-85.

Elliott, W.B., Van Ness, B.F., Walker, M.D. and Warr, R.S. (2006). What Drives the S&P 500 Inclusion Effect? An Analytical Survey, Financial Management, 35(4), 31-48.

FTSE (2005 – 2012). UK Index Series Quarterly Reviews.

FTSE (2012). Ground Rules for the Management of the FTSE UK Index Series, Version 11.2, June.

Gandhi, P., Golez, B., Jackwerth, J.C. and Plazzi, A. (2016). Financial Market Misconduct and Public Enforcement: The Case of Libor Manipulation, SSRN Working Paper 2342075.

Geiler, P. and Renneboog, L. (2015). Are Female Top Managers Really Paid Less? Journal of

Corporate Finance, 35, 345-369.

Gray, A. (2012). Resolution Hits Out at Watchdog, Financial Times, 28 March, 23.

Gregoriou, A. and Ioannidis, C. (2006). Information Costs and Liquidity Effects from Changes in the FTSE 100 List, European Journal of Finance, 12(4), 347-360.

Harris, L. and Gurel, E. (1986). Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressures, The Journal of Finance, 41(4), 815-829.

Harris, M. and Raviv, A., (1991). The Theory of Capital Structure, The Journal of Finance, 46(1), 297-355.

Heron, R.A. and Lie, E. (2007). Does Backdating Explain the Stock Price Pattern Around Executive Stock Option Grants? Journal of Financial Economics, 83, 271-295.

Investment Association, Asset Management Survey, (2015).

Kaul, A., Mehrotra, V. and Morck, R. (2000), Demand Curves for Stocks *Do* Slope Down: New Evidence from an Index Weights Adjustment, The Journal of Finance, 55, 893–912.

Kavanagh, M. (2011). Incubator Behind Polymetal's Move to London, Financial Times, 2 November, FT Online.

Levin, E.J. and Wright, R.E. (2006). Downwards Sloping Demand Curves for Stock? Studies in Economics and Finance, 23(1), 51-74.

Main, B.G.M. and Hine, J. (2012). Giving and Receiving. The Link Between Corporate Giving and Executive Pay, Working Paper, University of Edinburgh Business School.

Marriage, M. (2016), German Regulator Launches Closet-Tracker Investigation, Financial Times, February 15, FTfm 6.

Mase, B. (2007). The Impact of Changes in the FTSE 100 Index, Financial Review, 42, 461-484.

Mazouz, K., Daya, W. and Yin, S. (2014). Index Revisions, Systematic Liquidity Risk and the Cost of Equity Capital, Journal of International Financial Markets, Institutions & Money, 33, 283-298.

Merton, R. C. (1987). A Simple Model of Capital Market Equilibrium with Incomplete Information, The Journal of Finance, 42(3), 483-510.

Miller, E. M. (1977). Risk, Uncertainty and Divergence of Opinion, The Journal of Finance, 32, 1151–1168.

Mooney, M., (2016). Passive Funds Grow 230% to $6trn, Financial Times, Fm section, 30 May, 1-2.

Petajisto, A. (2009). Why Do Demand Curves for Stocks Slope Down? Journal of Financial and Quantitative Analysis, 44, 1013-1044.

Petajisto, A. (2011). The Index Premium and Its Hidden Cost For Index Funds, Journal of Empirical Finance, 18, 271-288.

Petajisto, A. (2013). Active Share and Mutual Fund Performance, Financial Analysts Journal, 69, 4, 73-93.

Platikanova, P. (2008). Long-Term Price Effect of S&P 500 Addition and Earnings Quality, Financial Analysts Journal, 64(5), 62-76.

Ryder, N. (2014). The Good, the Bad and the Down Right Ugly, Criminal Lawyer, 221, 5-6.

Scholes, M.S., (1972). The Market for Securities: Substitution Versus Price Pressure and the Effects of Information on Share Prices, The Journal of Business, 45(2), 179-211.

Shleifer, A. (1986). Do Demand Curves for Stocks Slope Down? The Journal of Finance, 41(3), 579-590.

S&P (2015). S&P U.S. Indices – Methodology, S&P Dow Jones Indices.

Table 1: Descriptive Statistics for Market Value and SIFs

Panel A	Sample	Mean	Median	Minimum	Maximum	Stdev.
Market cap	561	2381.67	2413.10	1088.20	3559.00	468.81
Market cap rank 90	561	2749.88	2763.50	1557.40	3604.20	492.91
Market cap rank 111	561	2078.30	2079.00	1084.10	2709.30	382.88
SIF Q+1	561	0.0009	0.0000	-0.3210	0.4750	0.0494
SIF Q+2	545	0.0047	0.0000	-0.3990	0.6290	0.0733
SIF Q+4	499	0.0073	0.0010	-0.6660	0.6590	0.1112
SIF Q+6	449	0.0110	0.0020	-0.8600	1.2800	0.1434

Panel B	Proportion of observations with large SIFs									
SIF	-20%	-10%	-5%	-2.5%	-1%	+1%	+2.5%	+5%	+10%	+20%
Q+1	0.0053	0.0107	0.0321	0.0515	0.0784	0.0499	0.0303	0.0232	0.0143	0.0089
Q+2	0.0092	0.0202	0.0587	0.0899	0.1321	0.0954	0.0642	0.0569	0.0404	0.0202
Q+4	0.0240	0.0501	0.0962	0.1543	0.2024	0.1743	0.1162	0.1062	0.0822	0.0361
Q+6	0.0356	0.0690	0.1314	0.1849	0.2405	0.2695	0.1782	0.1514	0.1158	0.0490

Notes: The table reports descriptive statistics for the sample firms. Panel A of the table reports the characteristics of our sample of index boundary firms (the ten smallest companies currently within the index (proxin), and the 10 largest companies currently outside the index (proxout)). The analysis is based on data just prior to each quarterly index revision date, over the sample period from March 2005 to December 2012. Market cap reports the mean market capitalisation for the sample firms. Market cap rank 90 reports the market capitalisation at which companies would on average have gained automatic index membership by virtue of being ranked within the top 90 eligible companies for index inclusion, while Market cap rank 111 indicates at what market value companies would on average have dropped out of the index by virtue of their market cap being smaller than that of the top 110 eligible companies. SIF Q+1 reports the average capitalisation change (net of any stock splits) for the sample firms over the next quarter after the ranking quarter, while SIF Q+2, SIF Q+4 and SIF Q+6 captures capitalisation changes over the next 2, 4 and 6 quarters, respectively. In Panel B we report the proportion of observations with SIF values in excess of a certain percentage. -20% refers to the proportion of observations with a negative SIF of 20% or more, -10% the proportion of observations with a negative SIF in excess of 10%, etc. Note that the categories are not mutually exclusive, and the observations in the category -20% are included in the category of -10%, etc.

Table 2: Position of companies prior to entries and exits from the FTSE100 Index

	Entries				Exits			
Rank category	Q-1	Q-2	Q-4	Q-6	Q-1	Q-2	Q-4	Q-6
1-10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11-20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21-30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31-40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
41-50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.067
51-60	0.000	0.013	0.016	0.048	0.040	0.028	0.048	0.017
61-70	0.000	0.013	0.031	0.000	0.013	0.042	0.111	0.050
71-80	0.000	0.000	0.000	0.048	0.067	0.083	0.127	0.150
81-90	0.000	0.026	0.047	0.081	0.093	0.250	0.254	0.117
proxin	0.000	0.079	0.188	0.081	0.787	0.472	0.175	0.200
proxout	0.731	0.474	0.188	0.129	0.000	0.097	0.175	0.217
111-120	0.141	0.171	0.188	0.145	0.000	0.014	0.016	0.083
121-130	0.064	0.118	0.078	0.161	0.000	0.014	0.016	0.017
131-140	0.051	0.013	0.109	0.048	0.000	0.000	0.016	0.000
141-150	0.000	0.053	0.063	0.113	0.000	0.000	0.032	0.017
151-160	0.013	0.026	0.031	0.016	0.000	0.000	0.000	0.017
161-170	0.000	0.000	0.016	0.048	0.000	0.000	0.000	0.017
171-180	0.000	0.000	0.047	0.016	0.000	0.000	0.016	0.000
181-190	0.000	0.000	0.000	0.032	0.000	0.000	0.016	0.017
191-200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Below	0.000	0.013	0.000	0.032	0.000	0.000	0.000	0.017

Notes: The table reports the ranking positions of companies 1, 2, 4 and 6 quarters prior to entries and exits from the FTSE100 index. The numbers reported are the proportion of companies entering or exiting the index from each rank category. The analysis is based on decile portfolios based on market capitalisation, for companies ranked 1 to 200 by market capitalisation. Companies ranked 1-10 are the ten largest companies in the UK by market capitalisation, proxin are the ten smallest companies within the FTSE 100 index, while proxout are the largest company outside the index. Only eligible companies are included.

Table 3: Capitalisation Changes Required to Gain FTSE 100 Membership

	Boundary position	1%	2.5%	5%	10%	20%
Companies outside FTSE 100 index	1	0.107	0.179	0.32.1	0.571	1.000
	2	0.000	0.000	0.16.1	0.387	0.903
	3	0.000	0.000	0.000	0.241	0.724
	4	0.000	0.000	0.000	0.094	0.563
	5	0.000	0.000	0.000	0.000	0.367
	6	0.000	0.000	0.000	0.000	0.241
	7	0.000	0.000	0.000	0.000	0.161
	8	0.000	0.000	0.000	0.000	0.071
	9	0.000	0.000	0.000	0.000	0.000
	10	0.000	0.000	0.000	0.000	0.000
Total sample		561	561	561	561	561

Notes: The table reports, for the companies currently outside the FTSE 100, what proportion would gain entry to the index (by means of being ranked within the top 90 companies eligible for index membership in the UK), given a 1%, 2.5%, 5%, 10% or 20% change in market capitalisation at quarter 0. A company ranked +1 is the largest company outside the index.

Table 4: SIF Increases in Excess of 10% for Largest 200 Firms

	Market Value Rank	Q1	Q2	Q4	Q6
Companies in FTSE 100 index	1-10	0.0037	0.0077	0.0286	0.0841
	11-20	0.0069	0.0249	0.0698	0.1017
	21-30	0.0309	0.0532	0.0923	0.1339
	31-40	0.0101	0.0210	0.0496	0.0763
	41-50	0.0034	0.0209	0.0460	0.0672
	51-60	0.0034	0.0035	0.0198	0.0493
	61-70	0.0000	0.0070	0.0577	0.1009
	71-80	0.0171	0.0213	0.0467	0.1111
	81-90	0.0000	0.0067	0.0304	0.0593
	proxin	0.0176	0.0471	0.0675	0.0833
	Average – in index	*0.0093*	*0.0213*	*0.0510*	*0.0869*
Index boundary					
Companies outside FTSE 100 index	proxout	0.0133	0.0411	0.1148	0.1639
	111-120	0.0137	0.0251	0.0888	0.1429
	121-130	0.0244	0.0399	0.0723	0.1318
	131-140	0.0174	0.0403	0.0653	0.1131
	141-150	0.0112	0.0304	0.0620	0.1286
	151-160	0.0037	0.0114	0.0327	0.0541
	161-170	0.0119	0.0320	0.0682	0.0918
	171-180	0.0080	0.0328	0.0724	0.1146
	181-190	0.0157	0.0328	0.0737	0.1027
	191-200	0.0157	0.0329	0.0888	0.1354
	Average – outside index	*0.0136*	*0.0320*	*0.0743*	*0.1188*
Overall average		*0.0114*	*0.0264*	*0.0622*	*0.1021*
Total sample		*5626*	*5447*	*4953*	*4437*

Notes: The table reports the proportion of observations with positive share inflation factors (SIF) in excess of 10%. The analysis is based on decile portfolios based on market capitalisation, for companies ranked 1 to 200 by market capitalisation. Companies ranked 1-10 are the ten largest companies in the UK by market capitalisation, proxin are the ten smallest companies within the FTSE 100 index, while proxout are the largest company outside the index. SIF captures the fractional change in the number of shares issued (adjusted for share splits, as appropriate) at the relevant quarter relative to quarter 0. Thus, for a company increasing its number of shares over time, the SIF number will be positive in quarters after the ranking quarter (Q+1 to Q+6).

Table 5: Financial Characteristics of the Boundary Firms

	proxout sample	proxout mean	proxin sample	proxin mean	nonprox sample	nonprox mean
DTA	272	0.2508	273	0.2529	4839	0.2304**
DY	272	2.7576***	273	3.0501**	4839	3.0294
MBR	272	3.0256**	273	4.1404**	4839	3.6856
MV	272	2274.88***	273	2779.86***	4839	8627.45***

Notes: The table shows a comparison of the mean values for firm characteristics for a balanced sample using the data for quarter 0 after exclusion of outliers. DTA is debt divided by total assets. DY is the dividend yield, MBR is the Market to Book ratio, MV is the market value of the company at quarter 0. Results are reported are after trimming outliers (negative MBR (146 observations) and MBR above 100 (39 observations)). Significance of an independent samples t-test is conducted as follows: proxout significance is vs nonprox; proxin significance is vs proxout; nonprox significance is vs proxin. ***, ** and * indicates significance at the 1%, 5% and 10% levels.

Table 6 Panel A: Probit analysis of companies making large issues

	(i)	(ii)	(iii)	(iv)
DV	SIF>+10%	SIF>+10%	SIF>+10%	SIF>+10%
Q+	1	2	4	6
proxout	0.0649	0.2172	0.3055**	0.2588*
proxin	-0.0037	0.0839	-0.1344	-0.2973
DTA	0.6561**	0.7577**	0.7154**	0.7751**
DY	0.0038	0.0300	0.0367	0.0228
MBR	-0.1202***	-0.0894***	-0.0645**	-0.0594**
LnMV	-0.0383	-0.0552	-0.0421	-0.0321
Cons.	-1.8555	-1.5735	-1.3272	-1.1043
Wald chi2	12.79	18.06	19.06	16.58
Prob > chi2	0.0465	0.0061	0.0041	0.0110
Pseudo R2	0.0363	0.0412	0.0343	0.0294
Total sample	5126	4996	4534	4046

Notes: The table reports regression output from probit models for the probability of firms to make large share issues. Panel A reports coefficients for probit models for large issues, while Panel B reports coefficient for probit models for subsamples of large issues. DV represents the dependent variable for the model. SIF represents the share inflation factor between quarter 0 and the subsequent quarter indicated (Q+). Dependent variables are dummy variables representing whether the company has issued or repurchased more than 2.5% or 10% of market capitalisation. proxout represents a dummy variable indicating that the company is in the largest ten companies outside the index at t0, proxin is a dummy variable which takes a value of 1 if the company is in the smallest ten companies which are in the index. DTA is Debt divided by total assets, DY is the dividend yield, MBR is the market-to-book ratio, LnMV is the natural log of the company's market value and Cons. is the regression constant. In Panel B, subsamples are All observations in model (i); proxout only in model (ii); proxin only in model (iii); non-proximity observations in the all sample in model (iv); Non-proximity observations inside the FTSE index in model (v); and Non-proximity observations outside the index in model (vi). Results reported are after trimming outliers (negative MBR (146 observations) and MBR above 100 (39 observations)). Significance of t-statistic is estimated using clustered robust standard errors using firm clustering. ***, ** and * indicates significance at the 1%, 5% and 10% levels.

Table 6 Panel B: Probit analysis of subsamples of companies making large issues

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Sample	all	proxout only	proxin only	non-prox (in or out)	nonprox (rank ≤ 100)	nonprox (rank >100)
DV	SIF>+10%	SIF>+10%	SIF>+10%	SIF>+10%	SIF>+10%	SIF>+10%
Q+	4	4	4	4	4	4
DTA	0.7336**	0.6024	3.2510***	0.6441*	0.7463	0.7427*
DY	0.0342	-0.0768	0.1211	0.0373	0.0457	0.0307
MBR	-0.0655**	-0.2888**	-0.2448**	-0.0551*	-0.0502	-0.0672
LnMV	-0.0463	0.4700	-0.3844	-0.0420	0.0047	-0.1795
Cons.	-1.2735	-4.1401	0.4266	-1.3369	-1.8479	-0.3082
Wald chi2	12.97	5.09	27.48	11.03	5.23	8.38
Prob > chi2	0.0114	0.2783	0.0000	0.0263	0.2643	0.0786
Pseudo R2	0.0307	0.0773	0.2354	0.0260	0.0260	0.0340
Total sample	4534	226	219	4089	2305	2003

Notes: The table reports regression output from probit models for the probability of firms to make large share issues. Panel A reports coefficients for probit models for large issues, while Panel B reports coefficient for probit models for subsamples of large issues. DV represents the dependent variable for the model. SIF represents the share inflation factor between quarter 0 and the subsequent quarter indicated (Q+). Dependent variables are dummy variables representing whether the company has issued or repurchased more than 2.5% or 10% of market capitalisation. proxout represents a dummy variable indicating that the company is in the largest ten companies outside the index at t0, proxin is a dummy variable which takes a value of 1 if the company is in the smallest ten companies which are in the index. DTA is Debt divided by total assets, DY is the dividend yield, MBR is the market-to-book ratio, LnMV is the natural log of the company's market value and Cons. is the regression constant. In Panel B, subsamples are All observations in model (i); proxout only in model (ii); proxin only in model (iii); non-proximity observations in the all sample in model (iv); Non-proximity observations inside the FTSE index in model (v); and Non-proximity observations outside the index in model (vi). Results reported are after trimming outliers (negative MBR (146 observations) and MBR above 100 (39 observations)). Significance of t-statistic is estimated using clustered robust standard errors using firm clustering. ***, ** and * indicates significance at the 1%, 5% and 10% levels.

Table 7: Predicted and Actual probability of large SIF

Rank category	*p*	N	Predicted SIF10%	Actual SIF10%	Abnormal SIF10%
1-10	0.0474	227	10.76	7**	-3.76
11-20	0.0511	256	13.08	20	6.92
21-30	0.0510	248	12.66	27***	14.34
31-40	0.0502	247	12.39	13	0.61
41-50	0.0559	249	13.91	14	0.09
51-60	0.0587	237	13.92	8**	-5.92
61-70	0.0604	232	14.00	15	1.00
71-80	0.0619	223	13.79	10*	-3.79
81-90	0.0626	203	12.70	10	-2.70
Proxin	*0.0620*	237	*14.69*	16	*1.31*
Proxout	*0.0629*	253	*15.92*	31***	*15.08*
111-120	0.0629	233	14.66	22*	7.34
121-130	0.0615	228	14.01	18	3.98
131-140	0.0608	217	13.20	15	1.80
141-150	0.0610	220	13.42	15	1.57
151-160	0.0608	210	12.77	9*	-3.77
161-170	0.0652	201	13.10	16	2.90
171-180	0.0659	196	12.93	15	2.08
181-190	0.0651	193	12.57	11	-1.57
191-200	0.0641	184	11.79	16	4.21

The table reports Predicted, Actual and Abnormal SIFs in excess of 10% for Q4. The analysis is based on decile portfolios based on market capitalisation, for companies ranked 1 to 200 by market capitalisation. Companies ranked 1-10 are the ten largest companies in the UK by market capitalisation, proxin are the ten smallest companies within the FTSE 100 index, while proxout are the largest company outside the index. Predicted number of large SIFs, denoted by Predicted SIF10%, is estimated by multiplying the probability of a large SIF (*p*) by the number of observations in each rank category (N). *p* is estimated as the average probability of a large SIF for observations within the relevant rank category, using Model (iv) in Table 6 Panel B. Abnormal SIF10%, the abnormal number of large SIFs, is estimated as the difference between the Actual and Predicted number of SIFs in excess of 10%. Statistical significance is estimated using a Chi-Square test. ***, ** and * indicates significance of the difference between the number of actual announcements in the specified rank category with the predicted value at the 1%, 5% and 10% levels.

Table 8: SIF Increases in Excess of 10% by Boundary Firms

Panel A

	Boundary position	Q1	Q2	Q4	Q6
Companies in FTSE 100 index	-10	0.0000	0.0000	0.0000	0.0000
	-9	0.0400	0.0400	0.0909	0.1053
	-8	0.0000	0.0357	0.0400	0.0435
	-7	0.0000	0.0000	0.0000	0.0000
	-6	0.0000	0.0000	0.0385	0.0417
	-5	0.0000	0.0000	0.0357	0.0800
	-4	0.0345	0.1333++	0.1481+	0.2000++
	-3	0.0690+	0.1071+	0.1154	0.0870
	-2	0.0323	0.0690	0.0769	0.1818+
	-1	0.0000	0.0000	0.0000	0.0000
	Average – in index	*0.0180*	*0.0407*	*0.0569*	*0.0769*
Index boundary					
Companies outside FTSE 100 index	1	0.0000	0.0000	0.0800	0.0870
	2	0.0000	0.0000	0.0385	0.0435-
	3	0.0000	0.0000	0.0000--	0.0400--
	4	0.0625+	0.1333++	0.2143+	0.2917+
	5	0.0333	0.1071	0.1923	0.2500
	6	0.0000	0.0345	0.1852	0.1667
	7	0.0323	0.0667	0.1429	0.2083
	8	0.0000	0.0000	0.0769	0.2083
	9	0.0000	0.0000	0.0455	0.2500
	10	0.0000	0.1000	0.1667	0.1765
	Average – outside index	*0.0141*	*0.0436*	*0.1146*	*0.1711*
Overall average		*0.0160*	*0.0422*	*0.0862*	*0.1247*
Total sample		*561*	*545*	*499*	*449*

Panel B

Absolute Value	Q1	Q2	Q4	Q6
Boundary position	-0.0319	-0.0111	0.0174	0.0526
In Index	0.0494	0.0762	0.0408	0.0734
Outside Index	-0.0123	0.0493	0.0538	0.1315**

Panel A reports the proportion of observations with positive share inflation factors (SIF) in excess of 10% over periods up to six quarters after the ranking quarter (quarter 0), for companies close to the FTSE 100 membership boundary. Companies ranked -10 to -1 are constituent firms of the FTSE 100 index, with company ranked -1 the smallest company in the index, while companies ranked +1 to +10 are outside the index, with a company ranked +1 the largest company outside the index. SIF captures the fractional change in the number of shares issued (adjusted for share splits, as appropriate) at the relevant quarter relative to quarter 0. Thus, for a company increasing its number of shares over time, the SIF number will be positive in quarters after the ranking quarter (Q+1 to Q+6). We test whether the proportion of companies in a particular ranking position in the index (e.g., -1) with large SIF differ from that of companies in other boundary positions within the index (positions -10 to -2), and similarly for boundary firms outside the index (positions +1 to +10 compared to each other), using a Chi-Square test. +++. ++, + indicates the proportion is significantly higher than that for the other categories, while ---, --, and - indicates the proportion is significantly lower than that for the other categories, at the 1%, 5% and 10% levels. Panel B reports the correlation between the absolute value of index positions, i.e., the proximity to the index boundary, and the dummy variable indicating SIFs of over 10% over periods of up to six quarters after the ranking quarter (Q0). *Boundary Position* is the absolute value of the index position from -10 to +10; *In Index* indicates the position of companies relative to the boundary which are inside the FTSE100 index; *Outside Index* indicates

the position of companies relative to the boundary which are outside the index.**indicates the Pearson correlation coefficient is significant at the 5% level.

Table 9: Absolute Changes in Rank, SIF and Firm Specific Variability

	Proximity	N	Mean	Median	Std. Dev.	Minimum	Maximum
One Quarter							
Rank	all	4873	7.24	4	8.84	0	88
SIF	all	4873	0.007	0.000	0.026	0.000	0.357
FS	all	4873	0.120	0.089	0.123	0.000	1.781
Rank	proxin	203	8.29	6	9.01	0	58
SIF	proxin	203	0.008	0.000	0.023	0.000	0.188
FS	proxin	203	0.134	0.101	0.128	0.001	0.934
Rank	proxout	247	8.75	6	8.77	0	62
SIF	proxout	247	0.007	0.000	0.022	0.000	0.166
FS	proxout	247	0.125	0.095	0.117	0.000	0.535

The table reports descriptive statistics for the absolute values of changes in rank position, the share inflation factor (SIF) and the firm-specific (FS) change in the market capitalisation of equity (i.e., adjusting the market value change for the change in the FTSE 100 stock market index level). FS captures the firm-specific market value change in excess of the change in the overall FTSE 100 index level, and is calculated as $FS = \left|\left(\frac{MVq \times (Index0/Index1) - MV0)}{MV0}\right]\right|$, where Index0 is the FTSE 100 index value at time 0, Index1 is the FTSE 100 index value at time 1, MV0 is the market value of the company at time 0, and MV1 is the market value for the firm in quarter 1. We calculate the absolute value of FS, as indicated by | | in the equation. 'all' refers to the full sample of companies ranked 1-200 by the market capitalisation of equity, 'proxin' to the ten smallest companies within the FTSE100 index, and 'proxout' to the ten largest companies outside the index.